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Name of the invention: Method of waterproofing fiber products

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Inventor: Son Kawamata

5-6-28-101, Yashio Shinagawa-ku, Tokyo

Inventor: Mineo Kato

25-20 Tsunashimadai Kohokuku, Yokohama-shi

Applicant: K.K. Hakuyosha

4-14 Kamiyamacho Shibuya-ku, Tokyo

Applicant: Nippon Sanso K.K.

16-7 1-chome Nishi-Shinbashi Minato-ku, Tokyo

Assigned representative: Denichiro Kido, Patent Attorney, and 2 others

## Detailed Report

### 1. Name of the invention

Method of waterproofing fiber products

### 2. Sphere of patent request

#### (claim 1)

This invention is regarding a method of waterproofing fiber products which uses a silicon or fluorine based waterproof agent and an assisting agent made of paraffin based hydrocarbon and liquefied carbonic acid gas which are applied to fiber products.

#### (claim 2)

It is regarding the method of waterproofing fiber products in claim 1 where the paraffin based hydrocarbon assisting agent is an isoparaffin based hydrocarbon with 5 to 16 carbon atoms and a boiling point of 120°C to 220°C, or azeotropic mixture which includes these.

### 3. Detailed explanation of this invention

#### (field of industrial use)

This invention is regarding a method of waterproofing fiber products (especially clothes) to be used in the fiber manufacturing or cleaning business.

#### (prior art)

Former methods of waterproofing fiber products are listed, for example, in Japan patent No. S 59-179876 (published in 1984). The original liquid waterproof agent is dissolved in water or in an organic solvent such as tetrachlorethylene. This solution is impregnated into the fiber, and waterproofing is done removing the water or organic solvent by air-drying or forced drying.

#### (problem that this invention tries to solve)

However, using this solution requires a lot of energy in the form of heat. During drying, fiber products sometimes shrink. When an organic solvent is used, in addition to fire or toxicity problems, the solvent must be collected, which leads to high cost.

Therefore, this invention was created considering the above problems, and its object is to offer a method of waterproofing fiber products which does not cause shrinkage and is easy, fast, and simple.

#### (step for solution)

This invention is a method of waterproofing fiber products which uses a processing agent that consists of silicon or fluorine based waterproofing agent and an assisting agent made of paraffin based hydrocarbon and liquefied carbonic acid gas which are applied to the fiber product by spraying or immersing.

This processing agent uses a hydrocarbon with an orthoparaffin (normal) or isoparaffin isomer as an assisting agent in order to attach the waterproofing agent to the

fiber products effectively. It is more effective to use isoparaffin. It is especially good to use isoparaffin with 5 to 16 carbon atoms that has a boiling point of 120°C to 220°C and also is liquid at room temperature.

(example of practice)

In the following, one example of practice of this invention is going to be explained based on figures. A processing agent which consists of a waterproofing agent such as silicon or fluorine and an assisting agent made of isoparaffin and liquefied carbonic acid gas is placed in a high pressure gas cylinder 2 on electronic scale 1 to a pressure of approximately 40 to 60 kg/cm<sup>2</sup>G. The electronic scale - part 3 of the panel, indicates the amount of this processing agent introduced into the cylinder.

The composition of this processing agent is: 25 wt.% Toray Silicon SH8011 as a waterproofing agent, 15 wt.% Shell Sol 71 (isoparaffin hydrocarbon azeotropic mixture, boiling point: approximately 200°C) as an assisting agent, and 60 wt.% liquefied carbonic acid gas.

Since the processing agent above has approximately 40 to 60 kg/cm<sup>2</sup>G self pressure, it is self-propelled in particle form into the drum 10 of a dry cleaner 9 from nozzle 8 through filter 5. This is controlled by an electromagnetic valve 7 which is opened and shut by an electromagnetic valve timer 6 on the control panel. This is done via a high pressure valve 4 with a siphon tube attached to the high pressure gas cylinder 2. The processing agent is attached to fiber products such as clothes inside the drum 10, the waterproofing agent is applied uniformly, and the carbonic acid gas is evaporated.

Next, treated fiber products are removed from the drum 10. After finishing by hot ironing, they are waterproof and are ready to be shipped.

The waterproofing process is not limited to the above method, and it is possible to apply this invention to fiber products by other methods such as immersing, etc.

Example of practice

In the following, one example of practice is going to be explained.

The agent used in the waterproofing process has the following components:

- (1) waterproofing agent: Toray Silicon SH8011 (product name)
- (2) assisting agent: ShellSol 71 (product name) note: isoparaffin hydrocarbon azeotropic mixture, boiling point: approximately 200°C
- (3) liquefied carbonic acid gas, note: pressure at room normal temperature, 55 kg/cm<sup>2</sup>G.

The composition has been mixed in the ratios shown in table 1. The effect of the waterproofing method in this invention was subsequently tested.

Table 1

	Agent A	Agent B	Agent C
(1)Waterproofing agent	25%	15%	10%
(2) assisting agent	15%	25%	30%
(3) Liquid CO <sub>2</sub> gas	60%	60%	60%

### Example of practice 1

Processing agent A and processing agent B were applied to three pieces of clothing (cotton, 300 x 300 mm) for 10 minutes according to the method in the example of practice above, and the clothes were waterproofed. Results of water-repellent tests on each sample conducted according to Japan Industrial Standard 1092 are shown in table 2.

In addition, as an example of comparison, test results for a sample which was processed by the former waterproofing agent (waterproofing agent which had dissolved 10 wt.% of waterproof agent (1) in tetrachlorethylene) for 10 minutes are also listed.

Table 2

Sample material	Processing agent	sample	Test results (points)	
			Trial 1	Trial 2
cotton	A	1	100	100
		2	100	90
		3	100	80
	B	1	90	80
		2	90	80
		3	80	70
	Example of comparison	1	80	80
		2	80	80
		3	80	80

### Example of practice 2

Processing agent B and processing agent C were applied to three samples of clothes (polyester 60 %, cotton 40 %, 300 x 300 mm) for 10 minutes according to the method in the example of practice above, and waterproofing was done. Results of water-repellent tests on each sample cloth conducted according to Japan Industrial Standard 1092 are shown in table 3.

Also, as an example of comparison, test results of the example of comparison for example of practice 1 are listed.

Table 3

Test material	Processing agent	sample	Test results (points)	
			Trial 1	Trial 2
60% polyester + 40% cotton	B	1	100	100
		2	100	100
		3	100	100
	C	1	90	90
		2	90	90
		3	80	80
	Example of comparison	1	80	90
		2	80	90
		3	80	80

(effects of this invention)

As stated above, this invention waterproofs fiber goods by applying a silicon or fluorine based waterproofing agent and an assisting agent made of paraffin based hydrocarbon and liquefied carbonic acid gas on fiber products by spraying or immersing. Bonding of the waterproofing agent to the fiber products is good. Fiber products will not shrink, and waterproofing equipment is simple. Workability is improved, and this enables fast and inexpensive waterproofing. In addition, safer than methods which use a waterproof agent and organic solvent together.

#### 4. Simple explanation of figures

Figure is shows one example of practice of the method of this invention.

Numbers use in the figure:

2: high pressure gas cylinder, 8: nozzle, 9: dry washer, 10: drum